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11. The process according to Claim 1 wherein said process is carried out at a temperature of from about 392°F to about 500°F.

REMARKS

Applicants respectfully request reconsideration of this application.

Claims 1-11 are presently in the application.

The present invention relates to an oligomerization process in which hydrocarbon feedstocks which include sulfur-containing molecules are contacted with a hydrotreating catalyst in the absence of hydrogen and in the liquid phase. The catalyst is a heterogeneous catalyst selected from supported reduced metals, metal oxides, metal sulfides and combinations thereof. Preferred catalysts include mixed nickel and molybdenum oxides or mixed cobalt and molybdenum oxides. The process can oligomerize sulfur compounds so that sulfur-containing feedstocks can be treated without deactivating the catalysts. Accordingly, untreated refinery streams can be used as oligomerization feedstocks without preliminary desulfurization.

Claim 1 has been amended to incorporate the limitation of claim 3 relating to the hydrocarbon feedstock comprising sulfur-containing molecules. This limitation has now been deleted from Claim 3. Claim 11 has been added to cover oligomerization conditions at relatively high temperatures of 392°F to about 500°F, support for which can be found at page 10, line 24 and page 6, line 13 of the Specification.

Rejections Under 35 U.S.C. § 102(b)

Claims 1, 2, 4, 5, 8 and 9 have been rejected under 35 USC § 102(b) as being unpatentable over U.S. Patent No. 4,098,839 to Wilms et al. (Wilms). Wilms is cited as teaching a process for oligomerizing unsaturated hydrocarbons by contacting with a catalyst under conditions including 80-180°C (176-358°F), 200-1500 psig and a WHSV of 0.8 to 2.5. The catalyst is described as one containing an alumina support, molybdenum with cobalt and/or nickel, which is activated in an oxidizing atmosphere such as air or oxygen to convert the catalyst metals from sulfide to oxide form. Wilms exemplifies a catalyst with cobalt oxide (CoO) and molybdenum oxide (MoO₃) on

alumina. The catalyst is described as being suitable for a liquid phase process. The Examiner asserts that inasmuch as Wilms does not disclose the use of hydrogen in the oligomerization reaction zone, the process is considered to disclose oligomerization in the absence of hydrogen. The Examiner concludes that Wilms' process employs essentially the same feed contacting step and catalyst as presently claimed.

This rejection is respectfully traversed.

Wilms oligomerizes unsaturated hydrocarbons with a molybdenum sulfide catalyst which has been treated in an *oxidizing* atmosphere at 300°-700°C. In contrast, the present invention utilizes a catalyst which is exposed to *sulfur*-containing compounds during oligomerization. Wilms also fails to disclose or suggest the present invention's requiring of sulfur-containing compounds in the feed. Moreover, Wilms oligomerizes at relatively low temperatures of 80-180°C (176-358°F). In contrast, the present invention can employ higher temperatures which enhance reactivity of the catalyst to form oligomers which conditions "are more severe than typical conditions used to conduct oligomerizations/polymerizations" (specification; page 6, lines 12-15). For example, new claim 11 employs oligomerizing temperatures of 392°F to about 500°F. Given these differences, it is respectfully submitted that the subject matter of the present claims is neither disclosed nor suggested by Wilms. Accordingly, withdrawal of this rejection under 35 USC § 102(b) is respectfully requested.

Claims 1, 2, 6 and 7 have been rejected under 35 USC § 102(b) as being unpatentable over U.S. Patent No. 4,628,138 to Barnett et al. (Barnett). Barnett is cited as teaching a process for oligomerizing ethylene by contacting with a heterogeneous catalyst in the form of a supported nickel/metal oxide promoter composition, optionally in the liquid phase. The Examiner urges that inasmuch as Barnett discloses oligomerizing without disclosing the use of hydrogen in the oligomerization reaction zone, the process is considered to disclose an oligomerization in the absence of hydrogen. The Examiner concludes that the present invention is anticipated by Barnett because it discloses an oligomerization utilizing essentially the same heterogeneous catalyst used by applicants.

This rejection is respectfully traversed.

Barnett oligomerizes olefins over nickel-omega zeolite catalyst comprising a nickelocene compound in the presence of a metal oxide promoter. However, the reference is silent regarding the presence of sulfur-containing compounds in the olefin feed, required by the present claims. Moreover, the reference teaches oligomerizing only at relatively low temperatures of 20°-70°C (68°-158°F). In contrast, the present invention can employ higher temperatures which enhance reactivity of the catalyst to form oligomers which conditions “are more severe than typical conditions used to conduct oligomerizations/polymerizations” (specification; page 6, lines 12-15). For example, claim 8 requires temperatures of 200°F to about 500°F, claim 9 requires temperatures of 250°F to about 450°F, while new claim 11 employs oligomerizing temperatures of 392°F to about 500°F. Given these differences, it is respectfully submitted that the subject matter of the present claims is neither disclosed nor suggested by Wilms. Accordingly, withdrawal of this rejection under 35 USC § 102(b) is respectfully requested.

Rejection Under 35 U.S.C. § 102(b)/§103(a)

Claim 3 (whose limitation relating to the presence of sulfur compounds in the feed have now been incorporated in amended claim 1) has been rejected under 35 USC § 102(b) as anticipated by or, in the alternative, under 35 USC § 103(a) as being obvious over U.S. Patent No. 2,558,137 to Hepp. Hepp is cited as teaching a process for treatment of a sulfur containing feed which involves oligomerization of olefins in the presence of a catalyst to convert sulfur containing compounds to higher boiling point sulfur compounds by reacting the former with olefin. The Examiner explains Hepp’s silence concerning “oligomerization” of the sulfur-containing compounds by arguing such oligomerization inherently occurs “because a higher boiling point sulfur compound is produced which is a combination of an olefin and the original sulfur containing compound.” The Examiner concludes the subject matter of claim 3 is anticipated by Hepp because it discloses essentially the same hydrocarbon/sulfur feed contacting step claimed by the applicants. In addition, the Examiner asserts the presently claimed sulfur-containing molecule oligomerization would obviously have been provided inherently by Hepp’s process.

This rejection is respectfully traversed.

Hepp fails to disclose or suggest the use of a *hydrotreating* catalyst as required by the present invention. Instead, Hepp uses a plain silica-alumina catalyst which is highly acidic in nature such as that employed in catalytic cracking reactions. Use of such highly catalytically active acidic catalyst for processing sulfur-containing feeds would be expected to rapidly deactivate such a catalyst, particularly under the higher temperatures specified by present claims 9 and 11 of the present application. Accordingly, one skilled in the art would not be led to the oligomerization of sulfur-containing molecules resulting from use of the hydrotreating catalysts of the present invention. Given these differences, it is respectfully submitted that the subject matter of the present claims is neither disclosed nor suggested by Hepp. Accordingly, withdrawal of this rejection under 35 USC § 102(b)/§ 103(a) is respectfully requested.

Rejection Under 35 U.S.C. §103(a)

Claims 2 and 10 have been rejected under 35 USC § 103(a) as being obvious over U.S. Patent No. 3,717,586 to Suggitt et al. (Suggitt). This reference is cited as disclosing a process for polymerizing (which the Examiner equates to oligomerizing) hydrocarbons in the form of olefins at 200° to 400°F and 300-800 psig with a catalyst containing an alumina support with nickel and/or molybdenum metal component.

This rejection is respectfully traversed.

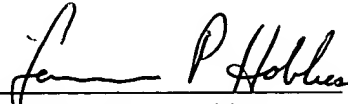
Suggitt teaches use of a fluorided catalyst containing Group VI or VIII metal components in polymerizing olefins. However, there is no disclosure or suggestion of sulfur-contaminated feed, as required by the present claims. Indeed, the reference teaches and solely exemplifies fluoriding platinum group metal-containing catalysts (column 6, lines 39-40) which are highly susceptible to sulfur poisoning. Accordingly, one skilled in the art would lack any incentive to substitute the sulfur compound-containing feeds required by the present claims, in the process of Suggitt.

In view of the failure of Suggitt to disclose or suggest the subject matter of the present claims, withdrawal of the rejection of claims 2 and 10 under 35 USC 103(a) is respectfully requested.

CONCLUSION

Applicants respectfully submit that the foregoing arguments obviate all of the outstanding rejections in this case and place the application in condition for immediate allowance. Allowance of this application is therefore earnestly solicited.

Respectfully submitted,

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